Reply to Research Review Team Data Request for the Southwest Fisheries Science Center, National Marine Fisheries Service

1. The Southwest Fisheries Science Center conducts an external review of one of its five Divisions each year. The most recent review was of the Salmon Research Program in Santa Cruz. Written comments of the reviewers are attached.

2. History and Mission

The **Southwest Fisheries Science Center** conducts marine biological, economic, and environmental research in California. Its mission is to provide scientific information and data to support conservation and management of marine fishes, populations of protected marine species, and essential fish habitat. Center headquarters is located in La Jolla, California, with two additional fisheries research laboratories in Santa Cruz and Pacific Grove, California. The Center's scientific responsibilities encompass a large and diverse geographic area and numerous protected marine species and fish stocks. Center research supports the scientific, statistical, and economic needs of the NOAA Fisheries Southwest Region, Pacific Fishery Management Council, and several international commissions, treaties, and agreements.

The **La Jolla Laboratory** specializes in fisheries of the California Current and the Pacific oceanic and Antarctic regions. A leader in vessel survey design and bioacoustic stock assessment, the laboratory conducts surveys to estimate abundance and monitor population trends of marine mammals, and to monitor early recruitment success of valuable west coast fish stocks using state-of-the-art methods developed at the laboratory. Research to assess the status of dolphin stocks most affected by the tuna purse-seine fisheries of the eastern tropical Pacific Ocean is a major undertaking at the laboratory. Genetic research on marine mammals, sea turtles and fishes is another area of focus. The laboratory also relates its fishery and protected species studies to the dynamics of ocean systems using NOAA satellite data and sea surface temperature imagery of the Pacific Ocean. The NOAA Fisheries Antarctic research program and National Sea Turtle Molecular Genetics Center are based at the La Jolla Laboratory. Other research includes studies of Pacific tuna and billfish stocks and economic studies to define and measure fishing capacity versus the productivity of world oceans. The laboratory's forerunners date to 1937; it opened in 1964 as the Fishery-Oceanographic Center in the Bureau of Commercial Fisheries and became NOAA's Southwest Fisheries Science Center in 1971.

At the **Pacific Fisheries Environmental Laboratory**, emphasis is placed on the study of environmental influences on marine resources. The laboratory provides oceanographic information to fishery scientists and managers, describes links between environmental processes and population dynamics of Pacific salmon and other important fish stocks, develops means to forecast fish population availability and resilience to fishing pressure, and assesses the effects of global climate change on oceanic processes important to fish population dynamics. It is the only place in the United States where fishery scientists can immediately and directly access information on ocean properties and processes occurring within the fishery habitat. Formed in 1969 as the Pacific Environmental Group, the laboratory joined the Center in 1976.

Research at the **Santa Cruz Laboratory** focuses on the fisheries and ecology of Pacific coast

groundfish and Pacific salmon (including 10 endangered salmon and steelhead runs), economic analysis of fishery data, and coastal habitat issues affecting the San Francisco Bay and the Gulf of Farallones. The laboratory scientists provide fish stock assessments to regional fishery management councils, study causes of variability in abundance and health of fish populations, and help to evaluate potential impacts of human activities on threatened or endangered species. This state-of-the art scientific research facility in central California opened in 2000. It replaced NOAA Fisheries' obsolete Tiburon Laboratory, which was established in 1961 by the Bureau of Sport Fisheries and Wildlife and became part of the Center in 1975.

3. Major Customers

The major customers of the SWFSC are:

(1) The fishing industry which is supported by research on the biology and population dynamics of harvested species enabling the long-term conservation of these species on the basis of a solid information base; (2) The recreational fishing constituency dependent upon similar species as catch or forage for which a sound information base is needed to maintain harvests at high levels; (3) the environmental constituency that is concerned about a healthy ecosystems, marine mammals, turtles, birds and any abuse of natural resources, and therefore needs to have a good understanding of the marine ecosystems, information we provide.

4. The SWFSC is a world-class research organization which conducts integrated, multi-disciplinary research programs in biology, mathematics, oceanography, and economics for the purpose of developing scientific technology and information to support the management and allo cation of Pacific coastal and high-seas fishery resources. These activities support the scientific, statistical, and economic needs of the Pacific Fishery Management Council and international commissions for large pelagic fishes and Antarctic resources. Center programs also support efforts directed toward the reduction of protected species interactions, fishery-related porpoise mortality, and a better understanding of the biological and environmental factors affecting the marine resources exploited by U.S. commercial and recreational fisheries. The Center provides the scientific information necessary to conserve and manage the following important fisheries in
the Pacific and Antarctic regions:

- Large pelagic fishes of the Pacific Ocean (tuna, billfish, shark, and swordfish)
- Groundfishes of the west coast (Pacific hake, rockfishes, lingcod, cowcod)
- Small costal pelagic species of the west coast (northern anchovy, sardine, mackerel, squid)
- Salmon of the west coast
- Antarctic krill, crabs, finfish (including Patagonian toothfish)

The Southwest Fisheries Science Center specializes in fisheries of the California Current, Pacific Oceanic, and Antarctic regions. Research is carried out on the ecology, population dynamics, fisheries, and stock assessment of small costal pelagic species, west coast groundfishes, Pacific billfish, tunas, and sharks (in collaboration with the Pacific Islands Science Center), and California salmon. The Center maintains and utilizes the largest database on tuna and tuna-related fisheries in the world. The Center makes extensive use of biological and fisheries data,

which are collected by observers placed on fishing vessels by the Southwest Region, to monitor interactions with protected resources to achieve goals related to the MSFCMA. It is also considered a leader in fish survey design, conducting surveys to monitor early recruitment success of economically important fish stocks along the U.S. west coast. It is a co-founder and co-participant in the Pacific Coastal Observing System (PaCOS) an extension of the now famous State-Federal California Cooperative Fisheries Investigations (CalCOFI), a comprehensive long-term study of the biology and oceanography of the California Current. In the Pacific, the Center is the leading source of stock assessment expertise on tunas, sharks, and billfishes for international commissions and for the Pacific Fishery Management Council. In the Antarctic, the SWFSC leads U.S. research directed at gathering ecological information to prevent overexploitation of fish and krill and to protect Antarctic living marine resources. The SWFSC provide oceanic environmental data and indices to the rest of NMFS as well as to other Federal, state, academic, and foreign fisheries scientists. Center scientists are leaders in the research and development of fisheries-relevant environmental data products. The SWFSC is home to a NOAA CoastWatch node at its Pacific Fisheries Environmental Laboratory.

In addition, the SWFSC has one of the strongest research teams in the U.S. addressing marine mammal stock assessment, genetics, and population biology. The program conducts regular stock assessments of marine mammals on the west coast, in Hawaii and in the Eastern Tropical Pacific. International research on species and stock differentiation using genetic methods is led by this team which has a record of moving the technology forward and which maintains an archive of 35,000 specimens. The research products of mammal stock assessments are used to determine permissible bycatch levels by the fishing industry and are subject to heavy public and legal scrutiny.

SWFSC scientists have taken the lead in characterization of large- and small-scale habitats that support white abalone, groundfish and bottomfish populations in deep water off California. This work requires an interdisciplinary approach from fishery biologists, geologists, and ecologists and couples the use of GIS with remote-sensing visual and acoustic tools, *in situ* survey techniques using remote operated vehicles, submersibles, and spatial analyses. This approach is being applied to the identification of EFH for various species, the improvement of stock assessment surveys, development of endangered species recovery plans and the evaluation of MPAs as an effective supplement to traditional fishery management. The National Ocean Service's MPA Center is cooperatively co-located with the SWFSC's Santa Cruz Laboratory.

The SWFSC maintains an active communications network with constituents, colleagues in the scientific professions, and the public to receive input for research planning, execution, and results. The network includes frequent dialogue with commercial and recreational fishers, leaders of environmental groups, participants of fishery management councils, state and Federal research agency staff, and outside scientists in the United States and foreign countries. Supporting this network is an infrastructure that includes cooperative agreements to support collaborative work with researchers in state agencies, universities, and foreign governmental agencies for collecting logbook and other types of fisheries data and for shared research projects; arrangements for data exchange; and contracts for charters of research vessels and specialty expertise. The SWFSC and its laboratories maintain up-to-date Internet sites that provide a range of information, including scientific reports and summary data bases available to other

researchers as well as the general public.

The SWFSC provides scientific and research support for U.S. commitments resulting from the following international arrangements and agreements in the Pacific region: (1) Convention for the Conservation of Antarctic Marine Living Resource (CCAMLR), which manages the marine living resources of the Antarctic; (2) Inter-American Tropical Tuna Commission (IATTC), which deals with tuna and tuna-like fishes, and the tuna-dolphin issue of the eastern Pacific Ocean; (3) South Pacific Tuna Treaty (SPTT), which provides tuna fishing access to the western Pacific Ocean; (4) North Pacific Interim Scientific Committee for Tuna and Tuna-like Species (ISC), which promotes research on tuna and tuna-like species of the North Pacific Ocean; (5) Standing Committee on Tuna and Billfish of the Secretariat of the Pacific Community (SCTB), which facilitates collaborative research on tuna and billfish of the western Pacific Ocean; (6) MEXUS Pacifico, which promotes joint U.S.-Mexico research projects of mutual interest; (7) North Pacific Albacore Workshop (NPALB), which promotes stock assessment research for north Pacific albacore; (8) Commission on the Conservation of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (MHLC), which will manage the highly migratory fish resources of the western and central Pacific Ocean; and (9) International Whaling Commission (IWC), which promotes conservation of whale stocks. In addition, SWFSC scientists periodically work jointly with other scientists on projects sponsored by international organizations such as the UN Food and Agriculture Organization (FAO), Global Ecosystem Dynamics (GLOBEC), and the North Pacific Marine Science Organization (PICES).

The Southwest Fisheries Science Center maintains an exceptional and growing fisheries economic research capability. Special studies are undertaken to help explain and evaluate the potential impacts of various management options on components of the fishery or the public. In addition, economic data collection and analyses are carried out to evaluate the economic health of fisheries or components of the fisheries.

4a. Fisheries stock assessment research is responsive to NOAA Ecosystem Goals, Fisheries Management - Assessment. Marine mammal research is responsive to NOAA Ecosystem Goals, Protected Species - Assessment and Protected Species - Survey, Monitoring and Observation. Some research programs of the SWFSC are responsive to Ecosystem Goals, Protected Species - Biology, Fishery Management - Survey, Monitoring and Assessment, and Fisheries Management - Biology.

4b. Geographic scope range from global (Antarctic, Pacific-wide) to regional (U.S. west coast). Applications of most research are global in nature and new technology is widely adopted.

4c. Time frames are nearly always greater than 5 years.

5. Major accomplishments of the SWFSC:

I. During 1997-2002 the Protected Resources Division devoted a substantial amount of its time, energy and resources toward addressing a query from Congress as to whether purse seine fishing in the eastern tropical Pacific (ETP) was having a significant adverse impact on depleted dolphin stocks. To address that question the PRD and contracted colleagues conducted an

extensive and intensive program of research that included: three multi-vessel abundance surveys of the ETP; collection, evaluation and analysis of a broad suite of environmental data to place the studies within an informed environmental context; an extensive array of studies of potential physiological stress or other indirect fishery effects including a directed cruise to study potential effects on individual dolphins using a chartered seiner and research vessel; and state-of-the-art assessment modeling. This program resulted in 34 separate research papers, plus an initial Report to Congress in 1999 and the 2002 Final Science Report. The SWC scientists who conducted this research were honored with the Department of Commerce Silver Medal at a ceremony in Washington, DC in December, 2003.

II. The SWFSC laid the foundation for the FMP for West Coast HMS well before the Council recognized a need for an FMP. The foundation included start-up of research on pelagic sharks before the need was recognized, maintaining the cooperative angler tagging and survey of billfish angling as a long time series of billfish angling data, and leadership in organizing and coordinating cooperative research with both international scientists (the North Pacific ALB Workshop and ISC) and U.S. industry (AFRF).

III. The Antarctic Division's most important contribution has been it's research program and the leadership provided to CCAMLR. Specifically, our finfish bottom trawl surveys have provided scientific information to CCAMLR which has allowed it to regulate the Antarctic Peninsula and South Orkney Islands fish stocks based upon sound scientific advice. In spite of interest in resuming fishing in those areas, our data and advice has been accepted and these areas remain closed to all fishing. With regard to the krill fishery, during the late 1990s the US was the only nation not willing to accept catch quotas based upon data collected in 1982. For several years, we formed subgroups at CCAMLR's Working Group on Ecosystem and Management (WG-EMM) to plan and direct a multi-discipline survey of CCAMLR's Area 48 to determine a new krill biomass estimate. In 2000, four nations each committed a ship for one month to systematic survey the area. These data now form the basis of the management of the Area. The lead author on the manuscript reporting these results was from the US. The US now serves as Chair of CCAMLR's Scientific Committee (SC) and Convener of the WG-EMM. In those positions, we have ensured that the precautionary catch quota for krill has been subdivided to smaller subareas and now we are leading efforts to establish division to smaller areas to protect predator demands near breeding colonies. Never before has one country been selected to lead two of the three CCAMLR Working Groups and SC. It is based upon a trust of the individuals and the recognition that the US research program is unbiased and of high quality.

IV. For over thirty years, the Pacific Fisheries Environmental Laboratory (PFEL) has focused on relating environmental variability to fluctuations in fisheries, marine mammals and protected resources. The degree to which marine resources respond to interannual changes in ocean conditions is critical to improving assessments of populations, as prescribed by the MSPA, ESA, and MMPA, and for implementing ecosystem-based management. Our research has led to innovative ways of looking at environmental and ecological variability, and has produced a number of important scientific publications and collaborations. This work focuses on building a mechanistic-based understanding of how climate variability direct or indirectly impacts living marine resources. This has culminated in documenting important rapid changes in ocean conditions that have coincided with observed changes in the distribution and production of many important fish stocks and marine

mammals.

Within the past five years, PFEL scientists and their colleagues have been following major physical and biological changes in the North Pacific. Analysis of recent atmosphere and ocean conditions in the context of long-term patterns indicates the region may have undergone a rapid and significant shirt to a new climate regime in about 1998. Several papers and scientific presentations by PFEL scientists were among the first to identify this regime shift.

Following the strong 1997-98 El Nino, the climate of the North Pacific underwent a rapid and striking transition. Many large-scale indicators of climate changed. Upwelling-favorable winds strengthened over the California Current (CC), and winds weakened in the Gulf of Alaska (GOA). Coastal waters of the CC and GOA cooled by several degrees. These changes showed similar patterns to those associated with past identified climate regime shifts (e.g., 1925, 1947, 1976). These historical shifts have been identified not only from environmental changes, but also from collapses and increases of commercially important fisheries. With our other NMFS colleagues, we have linked many ecosystem changes at all tropical levels to these environmental shifts.

V. A major and significant accomplishment from the Fisheries Resources Division over the last five years is a string of over 20 stock assessments of important species and stocks in the Pacific and California Current. These species are actively managed by the Pacific Fishery Management Council, Inter-American Tropical Tuna Commission or the National Marine Fisheries Service. These assessment are conducted under requirements of the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, Tuna Conventions Act, and other US commitments.

VI. The most significant accomplishment of the Santa Cruz Lab in the last 5 years is the important scientific contributions it's staff has made toward meeting NOAA Fisheries goals of building and maintaining sustainable fisheries and recovering protected resources. Specifically, scientists at the laboratory have conducted 9 stock assessments and 7 rebuilding analyses for west coast groundfish stocks that provided the essential evidence that many stocks have been harvested at unsustainable levels for many years. While unfortunately leading to the closure of groundfish fisheries along the continental shelf of nearly the entire west coast of the US, these results were essential to halting overfishing and implementing rebuilding plans that are leading to the recovery and reopening of these valuable fisheries. Additionally, Santa Cruz researchers have pioneered habitat mapping to define and describe essential habitat for groundfish species through a combination of acoustic and electro-optic imaging of seafloor habitats, *in situ* observation (manned submersible and remotely operated vehicle) of species-habitat relationships and GIS geo-referencing and layering. Finally, annual assessments of California's valuable and healthy ocean fisheries for chinook salmon are conducted by laboratory scientists.
All or part of 14 Evolutionary Significant Units (ESU) of chinook and coho salmon and steelhead trout occur in California, and 10 are listed as threatened or endangered under the Endangered Species Act. Scientists at the Santa Cruz Laboratory are conducting research on economics; molecular ecology; freshwater, estuarine and ocean ecology; behavior; physiology; population dynamics and extinction risk that represents much of the scientific basis of rational plans for restoration and recovery of listed stocks. Further, these same scientists have formed

Technical Recovery Teams of experts from academia, state and other federal agencies, which they chair, to assemble the relevant information and formulate the scientific basis of recovery plans.

6. Legal mandates for the SWFSC

The Southwest Fisheries Science Center conducts research, collects and compiles data and produces scientific advice in accord with the following Acts, Treaties, Conventions, Agreements, and International Plans of Action:

Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA)

Endangered Species Act (ESA)

Marine Mammal Protection Act (MMPA)

International Dolphin Conservation Program Act (IDCPA)

Tuna Conventions Act of 1950

Atlantic Tunas Convention Act (ATCA)

High Seas Fishing Compliance Act (HSFCA)

National Environmental Policy Act (NEPA)

Migratory Bird Treaty Act (MBTA)

U.S./Canada Albacore Treaty

South Pacific Tuna Treaty (SPTT)

Multi-Lateral High Level Conference for Conservation and Management of Tuna and Tuna-Like Species of the Central and Western Pacific (MHLC)

Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR)

International Convention for the Regulation of Whaling (IWC)

Convention for the Conservation of Antarctic Seals
Convention on International Trade in Endangered Species (CITES)

UN Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas

IPOA On Management of Fishing Capacity

IPOA On Conservation and Management of Sharks

IPOA On Incidental Seabird Catches in Longline Fisheries

7. Financial and staffing data for the SWFSC are correct in the table attached to the e-mail of February 10, 2004.

Salmon Research Program External Review, September 16-17, 2003

An external review panel composed of Dr. Robert C. Francis, Dr. Thomas P. Quinn, and Dr. Robert C. Vrujenhoek met on 16-17 October 2003 at the NMFS Santa Cruz Laboratory to review the Salmon Research Program. The first day of the review process comprised a series of oral presentations by staff scientists involved in carious aspects of the program including Salmon Population Analysis (Adams, Bjorkstedt, Lindley, Boughton, Mohr, Thompson and Tomberlin),

Early Life History Studies (Sogard), Ocean Ecology (Watters, MacFarlane, Freund), and Molecular Ecology (Hayes, Garza). The oral presentations and detailed review document, which included research abstracts and Curriculum Vitae, were of a uniformly high quality, reflecting high morale and enthusiasm among the scientific staff. On the second day, the review panel toured the Santa Cruz laboratory, visited a local salmonid study site (Scott Creek), interviewed several staff scientists, and prepared an outline of this report.

The review panel was most impressed with the exceptional balance that this program has achieved among various elements that might otherwise conflict for scientific attention and resources. The distribution of effort is very well balanced among the species of salmonids subject to the lab's jurisdiction (chinook salmon, coho salmon and steelhead trout). We also saw evidence of a balance between work in the coastal and Central Valley environments, and between fresh water and marine phases of salmonid life histories. Likewise, many components of the Salmonid Research Program exhibited a balance and interaction between empirical studies (both lab and field) and modeling efforts that will greatly strengthen the impact of research produced by this program. We see balance in all of these areas as great assets for the program.

An additional strength of this program lies in the age distribution of its scientific staff. It has excellent senior leadership, a remarkable staff of well-trained and enthusiastic young lead-scientists, and a number of talented post-doctoral researchers, graduate students, and technicians. Moreover, there exists a well-articulated desire on the part of the Directors to maintain a careful balance between mission-based research and studies of basic biological and physical processes affecting salmonids. Finally, the program presently has a good balance between 'hard' versus 'soft' funds to support staff and conduct scientific research. The component of 'soft' funds should be carefully and regularly evaluated, however, so that it is not overly leveraged against internal funds. An overzealous search for outside funding can divert attention from mission-oriented programs, indenture the scientific staff, and upset the carefully balances.

From the research standpoint, the panel recommends that the Scott Creek locality be developed as a long-term study site for the Salmon Research Program. This study site has several unusual properties that create exceptional research opportunities: proximity to the Santa Cruz Laboratory; occurrence of steelhead and coho salmon; presence of a small hatchery that cooperates with basic research goals; the availability of student researchers, and controlled access. The team should consider development of methods for monitoring physical data (e.g., temperature, salinity, etc.). It should also develop an ecosystem approach that includes data on other fish (sticklebacks and sculpins) and food sources (insects, etc.). However, there is always a risk in conducting an intensive study because it is unclear how typical that system is. We therefore strongly support the plans to conduct more extensive but less intensive work on a large number of coastal streams. The absence of salmonid data from these streams is clearly a barrier to thoughtful recovery plans as well as a basic understanding of salmonids at the southern end of their range.

Institutionally, the main challenge we see for this program will be to formulate plans that can maintain its present vitality over the long term. Programs aimed at retaining the best young scientists should be a priority, as the cost of living and housing in the region are very high. As permanent staff positions have been filled, means to rotate new talent, expertise, and vitality

(e.g., post-doctoral researchers, visiting scientists, dissertation projects, summer interns) should be strongly encouraged. Such rotations would be facilitated by the developed of temporary housing for short-term visitors and by the allocation of funds for visitor stipends. Finally, to maintain the present spirit and enthusiasm, the Director should develop a plan that recognizes the needs and accomplishments of each component program and its leaders. A plan to regularly upgrade advanced technologies and instrumentation should be developed. The current emphasis on publication in excellent peer reviewed journals needs to be maintained.

As research institutions grow and prosper they tend to fragment into subdisciplines that compete internally for limiting resources. The panel found the present focus on cooperation and interdisciplinary research particularly refreshing. To maintain this spirit of collaboration, the Centers needs to create a regularly scheduled program of scientific seminars and oral project reports that would involve each lead-scientist on an annual basis. Participation in these seminars should be expected of all the scientists and staff. Increased communications would help to foster the interaction between ecology, conservation, and statistics researchers with the economic analysis group at the Santa Cruz Laboratory (SCL) and with the modeling group at Pacific Fisheries Environmental Laboratory (PFEL). The panel also suggests that continuing efforts be made to integrate and expand research conducted at the SCL and PFEL through collaboration with university scientists both regionally and nationally. The high quality of the SCL facilities and the exciting research being conducted at the SCL and PFEL will be very attractive to outside scientists, and collaborative projects may prove to be a cost-effective way to increase the productivity of the lab and maintain the vitality of the staff.

In summary, we are unanimous in our praise for the program, and note that its quality reflects both the scientific and support staff, and the administration guiding the program.

Respectfully submitted,

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